

CLAIMS

1. A method for acquiring electromagnetic signals received from at least one part of a body (4) placed in a system comprising means for generating a magnetic induction  $B_0$ , said magnetic induction comprising gradients ( $G_x$ ,  $G_y$ ,  $G_z$ ) in certain directions in space, means for transmitting radio frequency (RF) wave pulse sequences perpendicular to the magnetic induction  $B_0$  in a range of adjustable frequencies, and means for detecting electromagnetic signals received from said body part, the method comprising the following steps:
  - a) injecting, into said body part, an amount of contrast product capable of being temporarily fixed in or of passing through an observed zone (1) of said body part, said contrast product comprising at least one element capable of causing a chemical shift of a resonance frequency of water hydrogen protons;
  - b) exciting said body part by means of a radio frequency wave pulse sequence in a range of frequencies adjusted according to the magnetic induction  $B_0$  and to the chemical shift for at least some of said radio frequency waves;
  - c) detecting, coherently with the excitation of step b), electromagnetic signals received from said body part, said signals corresponding substantially to magnetic resonance signals of the protons of the observed zone having undergone the chemical shift.
- 35 2. The method as claimed in claim 1, in which the element capable of causing a chemical shift and included in the contrast product comprises a lanthanide.

3. The method as claimed in claim 2, in which the lanthanide is chosen from at least one of dysprosium, praseodymium and europium.

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4. The method as claimed in any one of the preceding claims, in which the contrast product also comprises a cage that incorporates the element capable of causing a chemical shift, such as DOTA or DTPA.

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5. The method as claimed in any one of the preceding claims, also comprising a step consisting in forming an image from the electromagnetic signals received from said body part that are detected, according to a spatial coding dependent on the gradients (G<sub>x</sub>, G<sub>y</sub>, G<sub>z</sub>) of said magnetic induction.

6. The method as claimed in any one of claims 1 to 5, in which said radio frequency wave pulse sequence comprises a first series of wave pulses having a frequency adjusted selectively according to the magnetic induction B<sub>0</sub>, followed by a second series of wave pulses in a range of relatively nonselective frequencies adjusted according to the magnetic induction B<sub>0</sub> and to the chemical shift.

7. The method as claimed in any one of the preceding claims, in which said observed zone (1) comprises a group of blood vessels.

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8. The method as claimed in any one of claims 1 to 6, in which the contrast product is injected with a targeting molecule capable of being fixed to at least one target that is part of the observed zone (1).

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9. The method as claimed in claim 8, in which the target is a group of cells expressing a gene of said body part.

10. The method as claimed in any one of the preceding claims, comprising an additional step, at the end of step (a), consisting in irradiating said body part with a spectrum of radiofrequencies and in detecting the 5 electromagnetic signal frequencies received, so as to deduce therefrom a resonance frequency of the protons of the observed zone having undergone the chemical shift.

10 11. The method as claimed in claim 10, in which the observed zone (1) comprises a tumor zone of said body part and in which an indication of the concentration of contrast product fixed in or passing through the tumor zone is deduced from the resonance frequency of the 15 protons of the observed zone having undergone the chemical shift, this indication being a vascularization index for said tumor zone.

12. A contrast product intended to be injected into at 20 least one part of a body (4) for the purpose of acquiring electromagnetic signals from said body part, characterized in that it comprises at least one element capable of causing a chemical shift of a resonance frequency of water hydrogen protons.

25 13. The contrast product as claimed in claim 12, in which the element capable of causing a chemical shift comprises a lanthanide.

30 14. The contrast product as claimed in claim 13, in which the lanthanide is chosen from at least one of dysprosium, praseodymium and europium.

35 15. The contrast product as claimed in any one of claims 12 to 14, also comprising a cage that incorporates the element capable of causing a chemical shift, such as DOTA or DTPA.